United Nations
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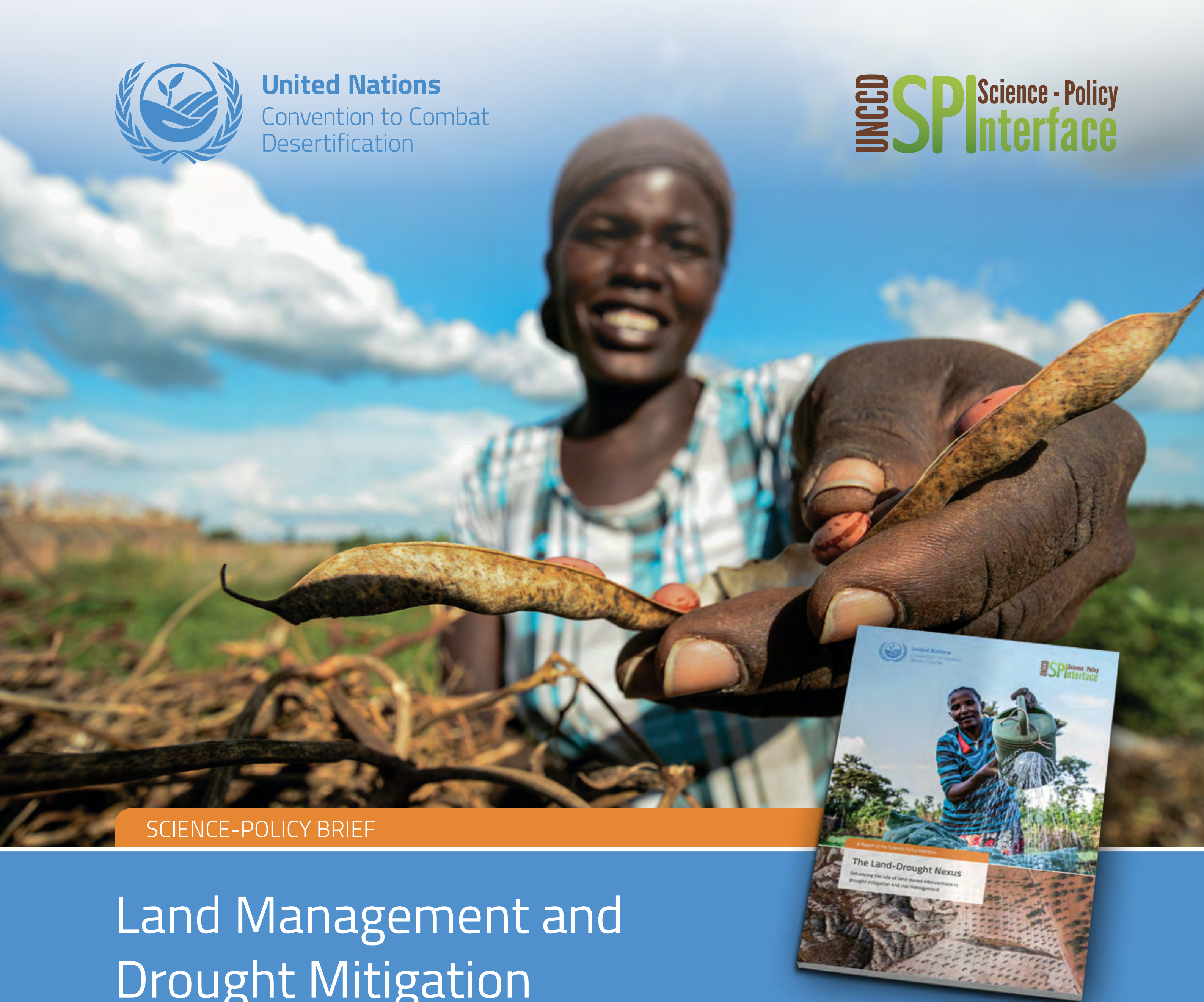
UNCCD SPI Science-Policy Interface



SCIENCE-POLICY BRIEF

Land Management and Drought Mitigation

Drought is one of the major drivers of global food and water insecurity, affecting agricultural production and access to food and water. Drought can, in extreme cases, force people to abandon their land, resorting to migration as their last livelihood strategy, making the prospect of ending hunger and malnutrition by 2030 more difficult. Land management practices offer opportunities for mitigating the effects of drought and, more generally, refocusing actions on "proactive drought risk management". It also increases the resilience of people and ecosystems to drought. An improved understanding of the relationship between land management and drought mitigation is urgently needed in order to improve the targeting and monitoring of interventions and policies.

DROUGHT

It is well recognized that there is no universally accepted drought definition. Drought definitions have been developed that extend beyond meteorological aspects to address impacts on the agriculture, hydrological, socioeconomic, and ecological sectors. Decision-makers must be aware that definitions of drought, water scarcity, and aridity may have implications on the effectiveness of associated policies, particularly when considering the land-drought nexus, as different definitions account (or do not account) for land in different ways.

Human activities can impact the level of water scarcity, and sometimes the severity and duration of droughts.

There are strong links between the drought-land nexus and human decisions on land use and land use change, which impact water availability and determine ecosystem and human resilience to drought. **Much more than just water inputs affect water security/scarcity. Other factors such as human actions/ planning, drought, and climate change also play a critical role in this process.**

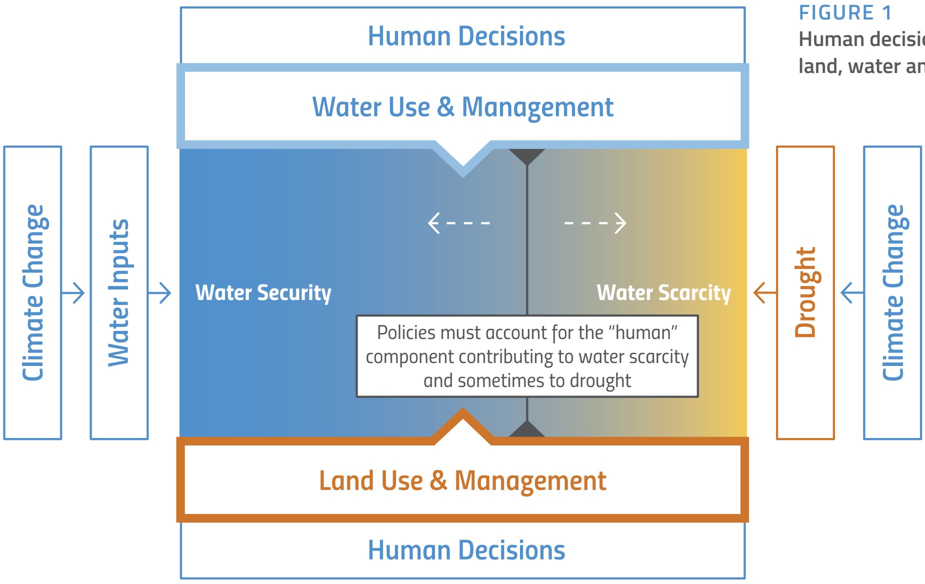
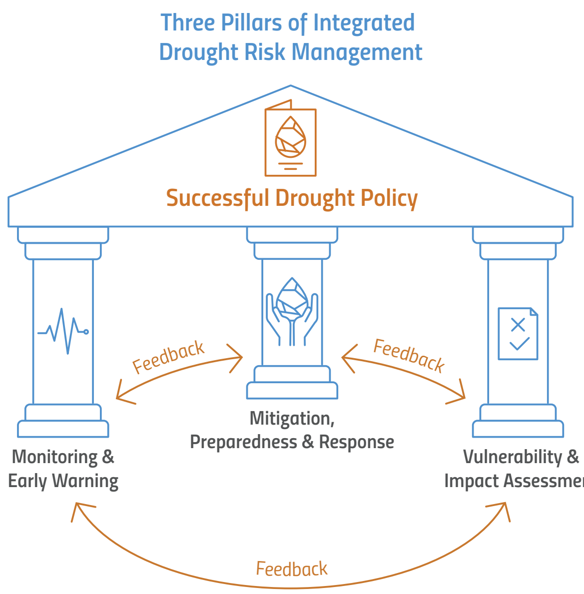


FIGURE 1
Human decisions impacting land, water and drought

A successful drought policy

Three pillars of integrated drought risk management form the building blocks of a successful drought policy. These three pillars are: (1) Monitoring and Early Warning; (2) Vulnerability and Impact Assessment; (3) Mitigation, Preparedness and Response.



Human activities and impacts on water scarcity need to be pro-actively taken into account in drought risk management and policy responses. Whereas healthy soils can store water that functions as a buffer in times of drought, human-induced land degradation reduces soil water holding capacity and amplifies water scarcity and increases the vulnerability to droughts. Hence, restoration or rehabilitation of degraded land and enhancing soil health can create better resiliency to drought. Soil loss, especially of the upper layers that contain most organic matter, leads to a reduction in the capacity to retain soil moisture. Land degradation can also contribute to a reduced infiltration of water. Impervious surfaces such as pavements seal the soil surface, eliminating rainwater infiltration and natural groundwater recharge.

FIGURE 2
Three pillars of integrated drought risk management

What is Drought-smart land management?

Sustainable land management (SLM), nature-based solutions (NbS), ecosystem-based adaptation (EbA), and ecosystem-based disaster risk reduction (Eco-DRR) are proactive, effective approaches for improving long-term ecosystem and human resilience. While all of these approaches have unique features, all provide examples of land-based interventions which are relevant in the context of drought.

Land-based interventions are actions tied to the sustainable use and management of land. A wide range of potential interventions confer resilience to drought, including certain types of infrastructure for water harvesting or erosion control, climate-smart agriculture practices such as conservation farming, technologies to improve water use efficiency, afforestation, and reforestation.

Drought-smart land management (D-SLM) characterizes land-based interventions for drought mitigation (i.e., against drought impacts and vulnerability). Such D-SLM interventions improve the capacity of soil to accept, retain, release and transmit water and increase plant water use efficiency. They can do so broadly by increasing the water supply where it is needed by living organisms (e.g. crop root systems) or by reducing water demand (e.g. drought-resistant crop varieties). D-SLM interventions contribute to avoiding, reducing and reversing land degradation under the LDN framework.

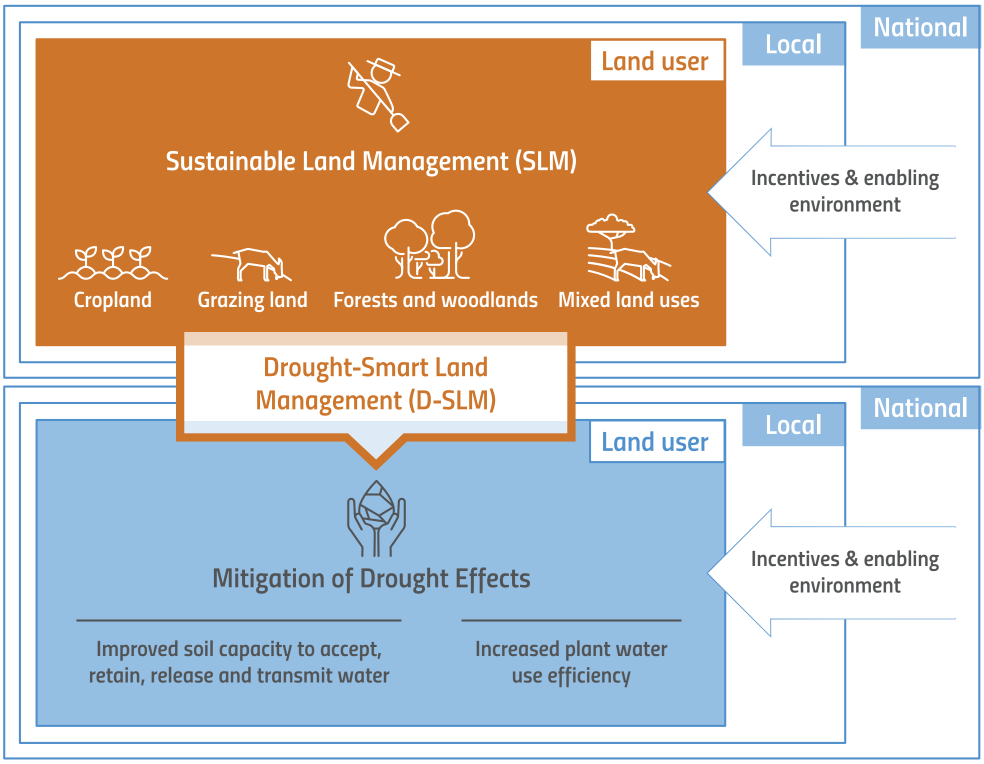


FIGURE 3
Drought-smart land management (D-SLM)

D-SLM measures positively contribute to drought risk mitigation, land degradation neutrality, biodiversity conservation, soil carbon sequestration, and allow for improved drought resilience without curtailing farmers' economic benefits.

GENDER-RESPONSIVE ACTIONS TO SUPPORT DROUGHT SOLUTIONS

A recent publication focusing on the connection between gender and drought (Mapedza et al. 2019), states that "Gendered understanding of droughts will help bring out the innovative solutions that women are developing to help cope and ameliorate the impact of droughts within the developing countries. Women need to be viewed as sources of solutions as they have to deal with the consequences of drought." To support gender mainstreaming, in 2017 the UNCCD adopted its first Gender Action Plan (GAP) which called upon UNCCD stakeholders to support and build upon technical capacities in the design and implementation of gender-responsive programmes (Collantes et al. 2018). Additionally. the Scientific Conceptual Framework for Land Degradation Neutrality brings gender equality issues to the center of LDN. Unpacking the complexities of gender, will enable a better understanding of how men and women are best able to cope with droughts in the developing world (Mapedza et al. 2019).

What can policy makers do right now?

To foster adoption and implementation of land-based interventions for drought mitigation and risk management, policy makers can play a crucial role by providing the right incentives via a set of five enablers: landscape approach, capacity development, good land, and water governance, geospatial analysis, and finance.

1. A "landscape" is a socio-ecological system. It includes: topography, natural resources, biodiversity, and culture, as expressed in various land uses. Droughts extend beyond administrative boundaries, therefore, an integrated landscape approach aids in problem-solving across sectors and boundaries. Moreover, a landscape approach is fundamental to LDN. Hence, for successful drought risk management, it is important to adopt landscape scale management of land and water resources and to understand how landscape management impacts people's livelihoods;

2. Developing capacity on the land-drought nexus and communicating the multiple benefits of D-SLM across sectors, communities of practice and disciplines is crucial. Enhancing the uptake and sustainability of D-SLM initiatives across sectors hinges on capacity in and communication on the multiple benefits of D-SLM across sectors, communities of practice and disciplines;

3. Good, effective and participatory land and water governance are as important to drought mitigation as the application of the best technologies because it creates the enabling environment for the adoption and scaling up of D-SLM and its associated technologies. Such an environment requires, *inter alia*, effective institutions combined with the empowerment of women (one of the majority groups among rural land and water users) and legal security (land tenure, water rights);

4. Remote sensing and geospatial information are powerful tools that can be employed to monitor and assess the status of land surface health or stress, detect environmental changes and assess the impacts of those changes. Integration of multi-temporal and multi-sensor data at various scales allows for the detection of crop-specific drought stress and can thereby support D-SLM by helping determine the effectiveness of strategies; and

5. Fostering and increasing awareness around D-SLM is linked to sufficient financing. Successful implementation of D-SLM and such initiatives depends on the effective mobilization of resources from all sources, including national budgets, partnerships with external donors and innovative sources of finance (e.g. interlinking with carbon financing through voluntary credits, public-private partnerships), ideally concurrent with local and national programming. D-SLM does not necessarily require additional financial resources, but usually involves redirecting and making more effective use of existing financing.

WHAT IS THE SCIENTIFIC EVIDENCE?

D-SLM measures can be organized into 14 groups made up of different types of strategies and interventions. These are considered with respect to four land use types (crop, grazing, forests and woodlands, and mixed). Taking into consideration the strength of scientific evidence of the effectiveness of these practices and their capacity to deliver multiple benefits the main findings are as follows:

a) There is robust evidence and high agreement that adoption of D-SLM practices alleviates the negative impacts of droughts on the productivity of croplands, grazing lands, forests and woodlands, and mixed land uses, including under climate change;[1]

b) There is high confidence that most D-SLM practices contribute to higher crop yields, especially after a long-term application, under water shortages and marginal soils;

c) There is medium confidence that D-SLM practices for improving pasture management have positive impacts on forage production and livestock productivity under droughts;

d) Many, but not all, D-SLM practices contribute to soil carbon sequestration (robust evidence, high agreement);

e) Application of D-SLM practices in degraded lands can positively affect biodiversity (medium confidence);

f) D-SLM practices have higher socioeconomic returns than conventional practices under droughts and in marginal soils. Many, but not all, D-SLM practices allow for improved drought resilience without curtailing farmers' opportunities to maximize their benefits during normal or wet years (robust evidence, medium agreement);

g) D-SLM practices enhance all dimensions of food security (medium evidence, high agreement); and

h) Further drought vulnerability and risk assessments in different contexts covering both natural (climatic, soil and water) and socio-economic aspects are needed for more ecologically effective implementation of the D-SLM practices in integrated and collaborative drought risk mitigation across ecosystems, administrative boundaries, and rural-urban landscapes.

1 The presented assessment makes use of the Intergovernmental Panel on Climate Change uncertainty language style, as presented at: <http://www.ipcc-wg2.awi.de/guidancepaper/ar5_uncertainty-guidance-note.pdf>.

Land Use	D-SLM Category	LDN Category	Upfront Costs	Net Economic Returns	Food Security and Poverty Reduction	Trade-Offs and Constraints
Croplands	Controlling soil erosion	Avoid, Reduce		Neutral and negative in the short term*, positive in the long-term	○	Labor availability could be a constraint
Croplands	Minimizing soil disturbance	Avoid, Reduce		Often, but not always, positive already in the short-term	+	Competition between uses of plant residues for mulching or for livestock feeding
Croplands	Integrated soil fertility management	Avoid, Reduce, Reverse		Usually already positive in the short-term	++	Competition between uses of livestock manure as soil amendment and energy source.
Croplands	Improved water management	Avoid, Reduce, Reverse	to	Usually already positive in the short-term, especially in arid environments or where water is priced.	+	Lack of water markets and pricing can limit incentives for their adoption
Croplands	Improved vegetation management	Avoid, Reduce, Reverse	to	Usually already positive in the short-term	+	May require technical capacities for their adoption by farmers
Grazing lands	Grazing pressure management	Avoid, Reduce		Usually already positive in the short-term	+	In some areas competes with expanding crop production
Grazing lands	Water management	Avoid, Reduce, Reverse	to	Limited evidence	○	Limited evidence
Grazing lands	Vegetation management	Avoid, Reduce, Reverse	to	Usually already positive in the short-term	+	Limited evidence
Forests/ Woodlands	Sustainable forest management, afforestation, reforestation, and of reducing deforestation	Avoid, Reduce, Reverse		Neutral and negative in the short term, positive in the long-term	+	Limited evidence
Mixed land uses	Adopting agro-forestry and agro-pastoralism	Avoid, Reduce, Reverse	to	Neutral and negative in the short term, positive in the long-term	+	Takes relatively long time for implementation
Mixed land uses	Water management	Avoid, Reduce, Reverse	to	Usually already positive in the short-term	○	Lack of water markets and pricing can limit incentives for their adoption
Mixed land uses	Integrated watershed management	Avoid, Reduce, Reverse		Positive in the long-term	○	Takes relatively long time for implementation
Mixed land uses	Urban green infrastructure	Avoid, Reduce, Reverse	to	Positive	○	Requires considerable technical capacities for planning and implementation

Avoid
Reduce
Reverse

○ Limited evidence

Source: the authors' compilation based on literature.
*Note: Drought-smart land management (D-SLM). *Short-term – one or two growing seasons.*

TABLE
Drought-smart land management: impacts, costs and benefits, synergies, trade-offs and constraints

Sustainable cattle production systems for the department of Cauca, Colombia © Juan Pablo Marin/CIAT

Aerial of rice production in Eastern Uruguay © Neil Palmer/CIAT

Women watering mukau sapplings in Kenya's arid Eastern Province © Flore de Preneuf/World Bank

UNCCD-SPI related publications

- A. Reichhuber, N. Gerber, A. Mirzabaev, M. Svoboda, A. López Santos, V. Graw, R. Stefanski, J. Davies, A. Vuković, M. A. Fernández García, C. Fiati and X. Jia. 2019. The Land-Drought Nexus: Enhancing the Role of Land-Based Interventions in Drought Mitigation and Risk Management. A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany.
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- UNCCD (2018) Gender Action Plan https://www.unccd.int/sites/default/files/documents/2018-01/GAP%20ENG%20%20low%20res_0.pdf

Further reading:

- Liniger, H., & Critchley, W. (2007). Case studies and analysis of soil and water conservation initiatives worldwide. University of Minnesota.
- Wilhite, Donald A.; Svoboda, Mark D.; and Hayes, Michael J. (2007). Understanding the Complex Impacts of Drought: A Key to Enhancing Drought Mitigation and Preparedness. Drought Mitigation Center Faculty Publications. 43. http://digitalcommons.unl.edu/droughtfacpub/43
- Mapedza, E., Giriraj, A., Matheswaran, K., and Nhamo, L., (forthcoming 2019). Drought and the Gendered Livelihoods implications for smallholder farmers in the Southern Africa Development Community region. In E. Mapedza, D.Tsegai, M.Brüntrup, R. McLeman Drought Challenges: Livelyhood Implications In Developing Countries (edited volume), Elsevier Publications (In Press)
- Collantes, V., Kloos, K., Henry, P., Mboya, A., Mor, T. and Metternicht, G. (2018). Moving towards a twin-agenda: gender equality and land degradation neutrality. Environmental Science and Policy, vol 89, pp: 247-253. https://doi.org/10.1016/j.envsci.2018.08.006

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UNCCD SPI Science - Policy Interface

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